

Preliminary Report on the Purbeck Characeæ.

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[PLATE 8.]

When we applied for a grant to aid in the working out of the Purbeck fossil *Characeæ*, we thought it was only a question of studying the anomalous structure of one, or perhaps of two, species, of which we had already gathered together a number of silicified specimens. It was thought that by polishing a large number of surfaces, or cutting slides of this cherty material, we should discover the links connecting the different parts of the plant. Further visits to Dorset provided, however, an enormous amount of new material, and the discovery of similar remains in a hard, close-grained limestone opened up new and better methods of research. The silicified *Characeæ* showed in section curious structures, so mineralised and so difficult to interpret, that it was most desirable to obtain specimens in the round, in order better to study their anatomy. This the calcareous blocks enabled us to do, though, on the other hand, some of the chert specimens preserved delicate non-calcified structures which were missing in the limestone.

On treating some of the limestone blocks with a steady drip of slightly acidulated water, the results were so surprising that we determined to devote most of the amount granted to the work of cutting all the more promising blocks into a series of thin slabs. Numerous slices were cut, and one side of each was then subjected for many hours to the drip. Most of the blocks proved to be partially and irregularly silicified, others were more or less dolomitised, a few were partly impregnated with a brown hydrocarbon. The drip rapidly attacked the pure calcite parts of the matrix and also the crystalline fossils, such as the mollusca, leaving the mineralised areas standing up. This, of course, was what one would expect. But more remarkable was the discovery that a great part of the characeous remains were not now pure calcite. Though not visibly different from the matrix, they are so mineralised as to resist the acid and to stand out in bold relief from the etched surface of the slab of limestone. We have even been able completely to remove fruits and stems from the matrix, though, as a rule, too long a continuance of the acid drip does at last affect the fossils, and it is better to let well alone when a specimen shows in sufficient relief.

The amount of new material thus obtained for the study of the fossil *Characeæ* is so great that it will take us a considerable time to complete the examination and photography. But already we have discovered that, instead of one or two species, there are certainly seven or eight, belonging apparently to four genera. We have that number of markedly distinct types of fruits, and we have about the same number of different types of vegetative organs. This wealth of material is one of the great difficulties in our way. Nearly every good block contains at least three of the types, and these fragile plants have been so broken up and mixed as to be difficult to disentangle. Until we can better correlate the different parts of each plant, and fix more definitely which type of fruit belongs to each, we shall not be satisfied, but meanwhile we will characterise the most abundant species, which is the type of a new and remarkable genus. For this plant we have now obtained the connection of the different parts, and have many specimens with the fruits attached.

The other species are much more rare, though we are gradually obtaining a knowledge of their anatomy. It will be necessary, however, in the coming year to gather more material and to have many more blocks sliced and etched, in the hope that they may give us the connecting links. We think, principally from a study of the association of the forms in each block, that we can with great probability correlate four other types of fruits with the vegetative parts to which they belong, but this correlation would have much greater weight if we could exhibit and photograph the actual attachment of the fruit to the branch, and of the branch to the stem, as can be done perfectly in the type species of our new genus.

Clavator, Reid et Groves (*gen. nov.*).

Caulis simplex, corticatus; axis e cellulis alternatim elongatis et abbreviatis compositus; cortex circa illas tubulosus, circa has fusiformiter tumidus, hoc modo caulem in internodia et nodos quasi dividens; capite tumido turbinato terminatus. *Internodia* e tubo centrali pariete crassa instructa, et cortice semper 12 tubolorum parvorum cylindricorum contiguorum inter se æqualium composita, omnia spatiis subæqualibus interjectis fasciculos symmetricos (rosellas) processuum emittentia. *Rosellarum* processus plus minusve producti, clavati, apice rotundati, quoquo versus divergentes, exteriore ad tubos corticales adnati, processus quisque poro basali cum parte interiore tubi corticalis conjunctus, poris processuum centralium solitariorum vel plurium plerumque majoribus quam processuum exteriorum. *Nodorum* *capitumque* structura admodum permutata, corticis tubi alternantes sex medium versus cito

ampliati, septis crassis in cellulas distinctas eo breviores quo latiores divisi, sex sensim angustati, extrinsecus propulsi, ideoque in sulcis inter tubos majores positi, omnes rosellas more internodiorum ferentes, majores præterea ramulos singulos verticillatim dispositos emittentes. *Ramuli* e cellula una tubulari et nonnullis abrupto expansis nodiformibus verticilla singula sex rosellarum more tuborum corticalium emitentibus constantes. *Fructus* solitarii, bini vel terni, uno latere (verisimiliter superiore) ramuli e rosellæ centro (?) orti, oogonia singula quasi bracteata referentes. *Oogonium* compositum ex ovo et ex cellulis 5 elongatis spiraliter tortis, iis Characearum recentium similibus, sed utriculo circumdate e cellulis bracteiformibus elongatis adnatis effecto vel iis inclusu. *Antheridia* ignota.

The principal characteristics of the genus appear to be—

1. The remarkable club-like nodes of the stem, from which we derive the name.
2. The production on the stem and branchlets of clusters of small clavate processes.
3. The presence of a utricle enclosing the oogonium.

The club-like nodes of the stem are of two kinds. The first, which we have styled "spindles" (Plate 8, fig. 13), taper at each end into the normal stem. Although we have not found two of the spindles connected, we conclude, from the fact that they are the more numerous, that each stem produced two or more of them. The second kind, which we have styled "heads" (fig. 5), are terminal and are turbinate, tapering below, and more or less flattened above. The normal stem forming the internodes is composed of a single thick-walled tube, surrounded by twelve equal contiguous sheathing tubes, or series of cells (figs. 9 and 10), resembling the so-called "cortex" of existing Charæ, except that the number is apparently constant. At the ends of the spindles and at the base of the heads a marked change takes place in the sheathing tubes, six alternate tubes rapidly enlarging and becoming broken up by well-marked transverse septa into separate cells, which diminish in length as they increase in diameter, the other six tubes gradually diminishing in diameter and being forced outwards, so that instead of, as in the internodes, lying side by side with the alternate tubes, they occupy the furrows between their outer curves (figs. 11 and 12).

The clusters of small clavate processes, which we have styled "rosettes," are produced at more or less regular intervals on the sheathing tubes of the stem, both on the nodes and internodes; they are symmetrical, the processes diverging in all directions, rosette fashion, the outer being adnate to the sheathing tube from which they originate. With the interior of the tube

each process is connected by a pore at the base, the central one or more of the pores being larger than the lateral; the processes are more or less elongated, swelling upwards, and are round-ended. Though occupying the same position, these processes are evidently not analogous to the spine-cells of living *Characeæ*, as they are not separate cells.

The head gives rise to a whorl of six branchlets, which are produced from the broadest part. Similar whorls occur on some (probably the upper) spindles.

The branchlets (fig. 3), which are spreading or ascending, are composed of a single tube, which becomes suddenly swollen at more or less regular intervals, producing whorls of six clusters of processes, somewhat resembling the rosettes of the sheathing tubes of the stem.

The fruits are produced singly, or two or three together, on one, probably the upper, side of the branchlets, taking rise from pores at the centre (?) of the rosettes.

The fruit consists of an oogonium with five spiral enveloping cells, as in existing *Characeæ*, but enclosed in a utricle formed or surrounded by a number of elongated adnate processes, somewhat similar to the bract-cells of living species of *Characeæ*, converging at the tips and nearly closing in the utricle. Little more than the calcified portion of these bract-like processes adnate to the fruit is preserved (see figs. 1, 2, 4, 6, 7, 8). Up to the present we have not found any trace of the antheridia.

We have no indication as to the stature of the plant, having found short portions only of the stem, and we have not made out any trace of a rooting system.

The foregoing description is drawn up from the remains of what is evidently the commonest species, but we have found others which, though different in some respects, belong apparently to the same type.

In 1891, Saporta, in his 'Plantes Jurassiques,'* described and figured as *Chara* fruits, under the name of *C. Maillardii*, some grooved pyriform bodies, which may be the utricles of a species of this genus.

The production of the "rosettes" is apparently a character shared by at least one of the other genera. The constant number of the branchlets (six) is probably common to all the *Characeæ* of these Purbeck beds, as well as the fixed number (twelve) of the sheathing tubes of the stem, when present.

Among the other genera is one evidently belonging to the *Nitelleæ*, having forked branchlets. This is apparently the first satisfactory instance of a

* 'Paléontolog. Franç.,' ser. 2, Végét. IV, p. 498, tab. 298 bis, figs. 6 and 7 (1891).

representative of this section being found in a fossil state. It is silicified not preserved in limestone.

EXPLANATION OF PLATE.

- Fig. 1.—Oogonium in utricle.
Fig. 2.—Longitudinal sections of two fruits.
Fig. 3.—Longitudinal section of part of branchlet, showing rosettes and a fruit attached.
Fig. 4.—Three fruits attached to branchlet, showing exterior of utricles.
Fig. 5.—Head, an elongated form, fractured obliquely.
Fig. 6.—Transverse section of fruit, showing portions of adnate bract-processes.
Fig. 7.—Utricle seen from above, with section of apex.
Fig. 8.—Longitudinal section of fruit and part of branchlet (silicified).
Fig. 9.—Transverse section of internode of stem, near thickened node, showing slight difference in size of sheathing tubes.
Fig. 10.—Two portions of stems showing rosettes.
Figs. 11 and 12.—Transverse sections of spindles or heads, showing very unequal diameters of sheathing cells, and the bases of some branchlets.
Fig. 13.—Longitudinal section of spindle, showing base of ascending branch.
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Clavator, n.g.



1.



2.



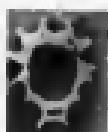
3.



4.



5.



6.



7.



8.



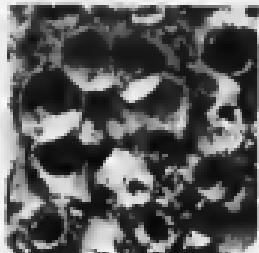
9.



10.



11.



12.



13.

Clavator, n.g.